A CLPS-DELIVERED ION-TRAP MASS SPECTROMETER FOR LUNAR SURFACE VOLATILES. B. A. Cohen[1], S. J. Barber[2], W. M. Farrell[1], and I. P. Wright[2]; [1]NASA Goddard Space Flight Center, Greenbelt MD (barbara.a.cohen@nasa.gov), [2]Open University, Milton Keynes, UK.

Introduction: Our ion-trap mass spectrometer was recently selected for development in the NASA Commercial Lunar Payload Services (CLPS) program. This mass spectrometer with heritage from the successful Ptolemy ITMS on Rosetta, which is currently also in development for the upcoming Luna-27 mission. We will monitor the tenuous near-surface lunar exosphere in response to natural and artificial stimuli (e.g., diurnal temperature cycle, lander activities). Our investigation will provide measurements of the exosphere to significantly improve our knowledge of the abundance and behavior of volatiles on the Moon, linking the lunar surface to LADEE measurements, and inform robotic and human mission design.

Lunar near-surface water: Multiple spacecraft observed water and hydroxyl in the lunar mid-latitudes [1-4]; yet water and OH have only been reported in the exosphere during meteor stream events [5]. These results have attuned researchers to critical new questions such as the source(s) of mid-latitude surface water, how it varies diurnally and seasonally, and what (if any) relation it has to volatiles in lunar permanently-shadowed regions (PSRs). Unfortunately, the only surface measurement, from the Apollo LACE experiment, was routinely swamped by artifacts from nearby equipment.

The ITMS will provide a modern measurement of OH/H_2O on the lunar surface, along with improved quantification of exospheric species of interest to both science and human exploration. This landed investigation would be useful anywhere on the Moon: equatorial siting would compare with LADEE, but polar would monitor migration of water molecules toward PSRs. Multiple measurements of the lunar atmosphere and surface-lander interactions would be extremely valuable, particularly from multiple landing sites and during different seasons.

ITMS development: The payload is an ion trap mass spectrometer with a unit mass resolution and an m/z range of 2 to 150 Da. The ITMS has strong heritage from the Ptolemy ITMS instrument that made the first in situ measurements of volatiles and organics on comet 67P with the Rosetta lander, Philae [6]. It operates in passive mode (i.e., no sampling mechanisms are required), "sniffing" its ambient surroundings with extremely high sensitivity and uniquely low (for a spaceflight MS) self-induced background. The technique was used during Rosetta's flyby of asteroid Lutetia [7] and at Comet 67P during Philae's "bounce" after landing [6], achieving detection limits of around 1E-10 mbar, some five orders of magnitude better than that achieved by the LACE experiment. The experiment will be a self-contained deliverable instrument, including the ITMS, directional baffle, and deployable dust cover, thermal insulation, electronics, and data and power harnesses.

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